Mash Tun Kinetics

3/4/2011

Malted barley -

- 80 % Soluble material
  - 92% - Carbohydrates
  - 8% - Proteins & Lipids
- 20 % Insoluble material
  - Husk, Proteins, ash

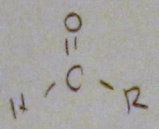
Carbohydrates

20 % Amylose → 1600-1900 glucose units long

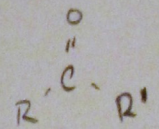
80 % Amylopectin → Amylose back bone with side chains 24-30 units

Glucose

$C_6H_{12}O_6$ →



Aldehyde → Aldose sugar



Ketone → Ketose sugar

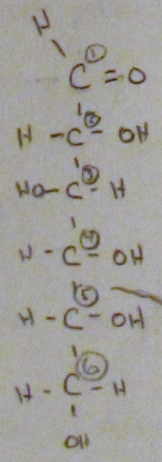
total # of Isomers

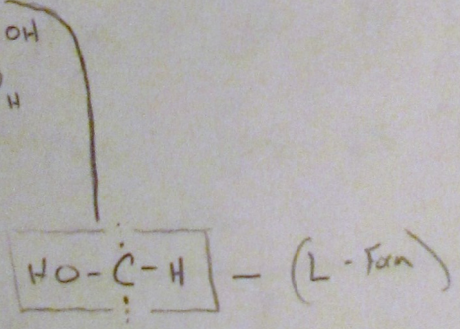
$= 2^3 \cdot 2^4$

$= 2^7$

128

D-Glucose



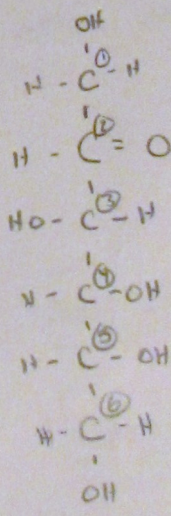


Last Asymmetric Carbon

F. Group on R = D

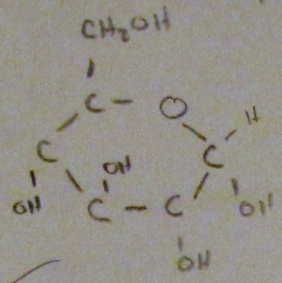
F. Group on L = L

D-Fructose

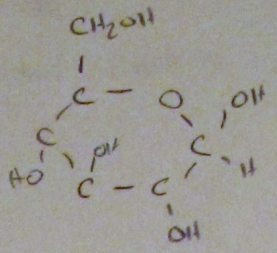


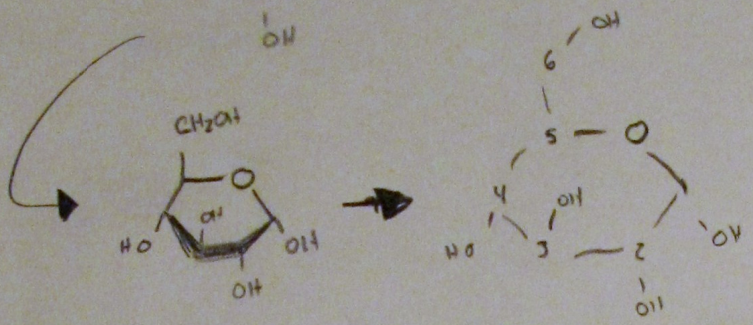
D- Glucose

α-D- Glucopyranose



β-D - Glucopyranose





* All glucose in Starch is found in α-D- Glucopyranose form

* Hand Out for molecular forms

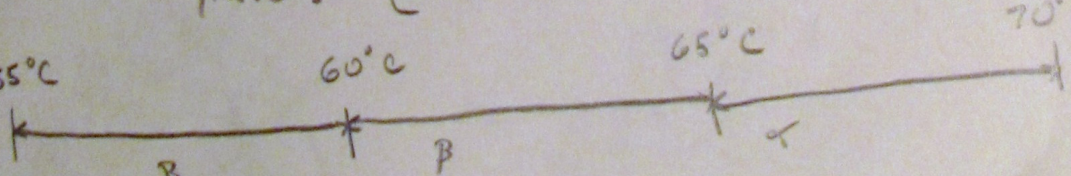
- Amylopectin → 6 % of bonds are branching chains

Amylopectin MW: $2 \times 10^6 - 4 \times 10^8$ → main → α(1,4) bonds; Side Chains → α(1,6) bonds

Amylose MW: $26 - 31 \times 10^4$ → All are α(1,4)- bonds.

Enzymes

- Alpha Amylase : [60 - 70 °C] [140 - 158 °F] → Forms during Malting
- Beta Amylase : [55 - 65 °C] [131 - 149 °F] → Forms in nature



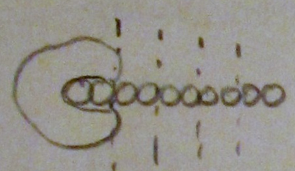
Enzyme Products

α	β
· Maltotriose	· maltose
Maltotetraose	· β- limit dextrins
· H.O.S. - Oligosaccharides	
· α- limit dextrins	

What happens?

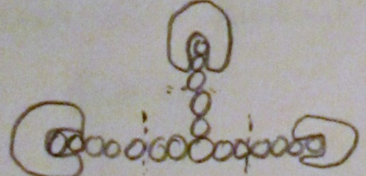
[β] works down the end of amylose & amylopectin molecules.

- Cleaves α(1,4) Glycosidic links every other glucose



- Maltose power house

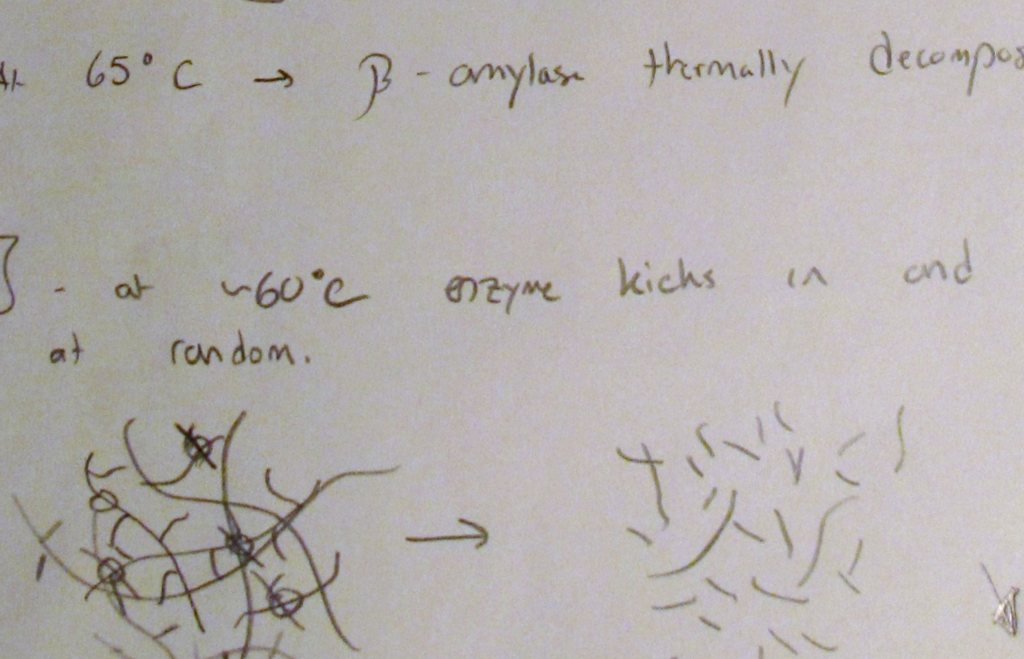
- When it reaches a branch on amylopectin, can only reach within 3 glucose units of bran.



→ leaves β-limit Dextrin

· At 65°C → β - amylase thermally decomposes

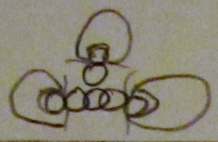
[α] - at ~60°C enzyme kicks in and attacks α(1,4) bonds α(1,6) at random.

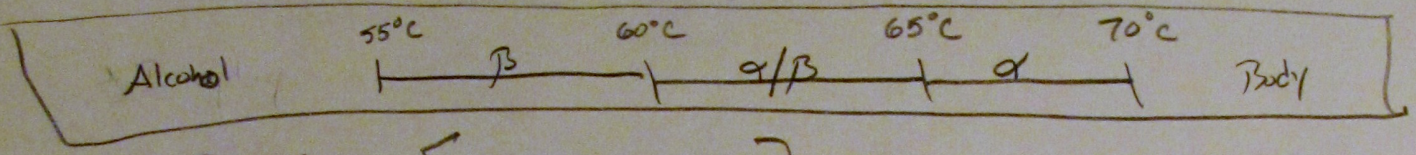


α-amylase cont

- makes many sugar fragments
- when it reaches a branch on Amylopectin, can attach within 1 Glucose unit

→ Alpha-limit dextrin





Products - [wort composition]

Alcohol Sugars

glucose –
Fructose – } – malting process
Sucrose –

Maltose – β

Maltotriose – α

× See molecules on handout
× See wort table

Body Sugars

Maltotetrase – α

Oligosaccharides – α

Dextrins – α/β